510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
DEVICE ONLY TEMPLATE

A. 510(k) Number:
#K023582

B. Analyte:
Activated Whole Blood Clotting Time (ACT)

C. Type of Test:
Quantitative

D. Applicant:
i-STAT Corporation

E. Proprietary and Established Names:
i-STAT® System Kaolin ACT Test

F. Regulatory Information:

1. Regulation section:
   CFR 864.7140
2. Classification:
   Class II
3. Product Code:
   JBP
4. Panel:
   Hematology (81)

G. Intended Use:

1. Intended use(s):
   The i-STAT Kaolin ACT is an in vitro diagnostic test which uses fresh whole blood to monitor high-dose heparin anticoagulation frequently associated with cardiovascular surgery.
2. Indication(s) for use:
   [Same as Intended Use]
3. Special condition for use statement(s):
   N/A
4. Special instrument Requirements:
   i-STAT Portable Clinical Analyzers, Models 200 (#K940918 and #K001154); and 300 (#K001387).

H. Device Description:
The i-STAT Kaolin ACT Test consists of a single test cartridge, upon which a fresh whole blood sample of 40 ul is placed. The Kaolin ACT Test cartridge uses the same electrogenic substrate technology as the i-STAT Celite ACT Test cartridge. Both are composed of plastic components that house sensor chips and fluid conduits. Reagents are coated on the cartridge cover and consist of an activator, thrombin substrate and inert matrix components. The sample is mixed with the reagents in the sensor channel, where activation of the coagulation cascade and detection of clot formation occur.

I. Substantial Equivalence Information:

1. Predicate device name(s):
   International Technidyne Corporation (ITC) Hemochron® Activated Whole Blood Clotting Time (K-ACT Test tube); i-STAT Corporation Celite Activated Clotting Time Test cartridge.

2. Predicate K number(s):
   #K913861; #K992571

3. Comparison with predicate:

Similarities		
Item	**Device**	**Predicate**
Intended Use	For in vitro diagnostic use in monitoring high-dose heparin anticoagulation frequently associated with cardiovascular surgery.	For in vitro diagnostic use in monitoring heparin anti-coagulation during cardio-vascular procedures.
Samples	Fresh whole blood	Whole blood
Measuring temper-ature	37º C.	37º C.
Measuring units	Seconds	Seconds
Reference range – (normal donor, venous)	89 – 137 seconds	91 – 151 seconds
Reference range (CPB patients, arterial)	107 – 160 seconds	110 – 154 seconds
Heparin linearity/ prolongation	50 – 1000 seconds/30 - 118 seconds per U/mL heparin.	0 – 1500 seconds/33 – 109 seconds per U/mL heparin.
Inhibited platelet effect	Extension	Extension
Aprotinin effect (extension)	Approximately 3.0%	Approximately 3.2%

Differences		
Item	**Device**	**Predicate**
Sample volume	0.04 mL	2.0 mL
Detection method	Electrochemical marker	Mechanical (magnetic)
Reagent format	Test cartridge with kaolin activator and synthetic thrombin substrate.	Glass test tube with kaolin activator
Display for 'out-of-range' results	>1000 seconds	flashing 1500 seconds
Imprecision (controls) (whole blood, total)	2.1 – 4.8 % CV 9.8 –13.2 %	5.3 – 6.2% CV 11.0 –19.2%
Sample temperature effect	None	Inversely proportional: ~1 % prolongation for each 1º C. decrease below 37º C.
Fibrinogen sensitivity	Insensitive between 105 – 514 mg/dL.	Insensitive < 100 mg/dL.

J. Standard/Guidance Document Referenced (if applicable):

N/A

K. Test Principle:

The i-STAT ACT Test endpoint is indicated by the appearance of an electroactive marker generated by thrombin-mediated conversion of a synthetic substrate included in the reagent. It employs the same electrogenic substrate technology as the company's Celite ACT Test (#K992571). A whole blood sample is introduced into the sample well of the cartridge which is then placed into the analyzer. The test endpoint is indicated by the time that corresponds to the appearance of a current plateau, and is due to the conversion of the "MeoPADA" substrate detected by the electrochemical sensor.

L. Performance Characteristics (if/when applicable):

1. Analytical performance:

a. Precision/Reproducibility:

Various imprecision components were tested in-house and at (3) clinical sites, according to NCCLS EP-5A document. Two levels of controls were tested on (3) cartridge lots by (3) different operators. All results ranged from 0.1 – 5.4% CV.

b. *Linearity/assay reportable range:*
Heparin sensitivity was determined by a dose response of 1.5 – 8 U/mL heparin over a range of 50 – 1000 seconds.

c. *Traceability (controls, calibrators, or method):*
The i-STAT Celite ACT substrate, NIST certified reference electrode and gold film sensor for the amperometric endpoint.

d. *Detection limit:*
1.5 mL heparin

e. *Analytical specificity:*
No fibrinogen interference < 100 mg/dL; Factor deficiencies and other coagulopathies may cause interference.

f. *Assay cut-off:*
N/A

2. Comparison studies:

a. *Method comparison with predicate device:*
Studies were performed at (3) representative point-of-care clinical sites, using (3) lots of i-STAT Kaolin cartridges. Samples were obtained from male and female cardiovascular patients, ranging from 44 – 85 years of age. Some samples contained aprotinin and/or protamine; and all hematocrits ranged between 14 – 42%.

i. Data from the University of Michigan Medical Center (N = 311) ranged:
Y = 111 – 118
S = 0.949 – 0.982
I = -14 to -10
R = 0.905 – 0.910

ii. Data from the Baptist Hospital (N = 352) ranged:
Y = 76 – 87
S = 1.040 – 1.075
I = -46 to -34
R = 0.934 – 0.946

iii. Data from the Florida Hospital (N = 313) ranged:
Y = 60 – 61
S = 0.913 – 1.047
I = -56 to -29
R = 0.971 – 0.974

b. *Matrix comparison:*
N/A

3. Clinical studies:
    a. *Clinical sensitivity:*
    N/A
    b. *Clinical specificity:*
    N/A
    c. *Other clinical supportive data (when a and b are not applicable):*
    Other clinical data were presented in various literature references included in the Original submission and the Supplement, dated 7/24/03.
4. Clinical cut-off:
    N/A
5. Expected values/Reference range:
    The reference range for normal volunteers (N = 120) on venous blood is 89 – 137 seconds (95% C.I.). The range for pre-procedural baseline (arterial) blood (N = 79) is 107 – 160 seconds (90% C.I.).

M. Conclusion:

There is no reference standard for the ACT Test, however, based upon extensive studies performed with the proposed i-STAT Kaolin ACT, and from data and information submitted in several literature references, the device is considered substantial equivalent to the ITC Hemochron ® Activated Whole Blood Clotting Time (K-ACT) Test.